Astrobiological site assessment using in-field instrumentation for the detection and characterization of biomarkers in hot spring environments, Kamchatka peninsula, Russia

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Recent exploration efforts on Mars and in terrestrial analogue environments have demonstrated the importance of comprehensive investigation of test environments in the search for possible evidence of traces of microbial life. We have tested a comprehensive suite of analytical instrumentation in the field for their potential applicability in initial astrobiological field site characterization, including highly sensitive LAL assays to determine the presence of bacterial cells, ATP measurements to determine relative metabolic activity, and microarray analyses for initial characterization of the observed organisms/communities. Field sites are sampled for detailed laboratory studies including microbiological investigation and PCR/DNA sequencing to identify microorganisms. In addition, organic geochemistry studies are carried out to characterize biomarkers of associated past life.

The test sites presented in this paper are active volcanic hot spring systems in cold environments of the Kamchatka peninsula, Russia. Initial results of field data indicate that such an approach provides comprehensive information that assists in determining field sites for further detailed investigation in simulation of remote planetary exploration rover.